REMARKS

I. Introduction

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 14-18 Under 35 U.S.C. § 102

Claims 14-18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by JP 2001-015012. Applicants respectfully traverse these rejections for at least the following reasons.

With regard to the present disclosure, independent claim 14 recites a carbonaceous material projection structure comprising a plurality of carbonaceous material projections provided according to a predetermined arrangement, a density of the carbonaceous material projections being not less than 4 projections/μm^2, and tips of the projections being smaller than roots of the projections.

In addition, independent claim 15 recites a carbonaceous material projection structure comprising a plurality of carbonaceous material projections provided according to a predetermined arrangement, each carbonaceous material projection having an approximately conical shape, and an apex angle of each carbonaceous material projection being not more than 39 degrees.

One feature of the present disclosure is that the carbonaceous material projection structure comprises a plurality of carbonaceous material projections provided according to a predetermined arrangement. As a result of this predetermined arrangement, the emission of electrons is facilitates because a regular arrangement can define the distribution of electric field

over the carbon projections and achieve appropriate electric field strength for each carbon projection.

It is alleged in the Office Action that JP 2001-015012 teaches an emitter formed from pyramid shaped diamond protrusions having a height of 1 μm and a density of 25 projections per μm. As such, the Office Action concludes that given the density of the diamond tips and the height of the tips, the emitter would inherently have an apex angle within the Applicant's claimed range. Applicants respectfully disagree that JP 2001-015012 teaches the claimed carbonaceous material projection structure.

As is discussed in paragraphs [0016]-[0017] and shown in Figs. 1 and 2 of JP 2001-015012, after patterning a 1 μm thick gate hole with the resist mask 5, diamond particles 6 are made to sparsely adhere to the substrate face. Then, after removing the resist mask 5, a diamond system carbon film 7 is grown on the substrate 1 and an ECR plasma surface treatment is carried out to make graphite system carbon with a needlelike projection structure. Fig 2(d) shows a carbon film 2 having a number of needles, each formed by ECR plasma without a mask. As is clearly shown in this figure, the needles are arranged in a random manner. The positions of these needles are **not** controlled because no mask was used during the ECR plasma formation step. In fact, JP 2001-015012 teaches that the needle density is anywhere from 25 to 1,000,000 needles per μm. In contrast, the present disclosure shows in Fig. 8a, a controlled, predetermined regular arrangement of projections of needles. Accordingly, it is not inherent that JP 2001-015012 teaches a plurality of carbonaceous material projections provided according to a predetermined arrangement.

Anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently in a prior art reference, *Akzo N.V. v. U.S. Int'l Trade*

Commission, 808 F.2d 1471 (Fed. Cir. 1986). At a minimum, for the reasons set forth above, JP 2001-015012 does not disclose a plurality of carbonaceous material projections provided according to a predetermined arrangement. Therefore, as it is apparent from the foregoing that 2001-015012 fails to anticipate independent claims 14 and 15 or any dependent claims thereon, Applicants submit that claims 14 and 15 are allowable and patentable over the prior art. As such, Applicants respectfully request that the § 102 rejection be withdrawn.

III. The Rejection Of Claims 9-18 Under 35 U.S.C. § 103

Claims 9-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over 2001-015012 in view of Baik et al. (Thin Solid Films 377-378 (2000) 29-302) and further in view of Cathey (USP No. 6,423,239) and Ageno (USP No. 5,449,435). Applicants respectfully traverse this rejection of the pending claims for at least the following reasons.

With regard to the present disclosure, independent claim 9 teaches a method of forming one or more carbonaceous material projections, the method comprising the steps of:

applying a resist onto a carbonaceous material substrate; forming holes in the applied resist, the holes being provided according to a predetermined arrangement, each hole having a wall surface, and the wall surface being inversely tapered from an aperture thereof toward a bottom thereof; depositing mask material for a mask on the carbonaceous material substrate to form a mask deposition in each hole; lifting off the mask material deposited on the resist together with the resist; and

etching the carbonaceous material substrate by using the mask deposition as a mask to form one or more carbonaceous material projections.

One feature of the present disclosure is a method for forming a carbonaceous material projection by applying a resist followed by applying a mask, followed by lifting off the mask material deposited on the resist together with the resist and then etching the substrate to form a carbonaceous material projection.

In contrast to the present disclosure, none of the cited prior art references teach applying a resist layer followed by applying a mask. The failings of JP 2001-015012 are discussed above. Baik teaches only using a mask before etching the carbon substrate. It is alleged that Cathey teaches using a mask and resist system. However, as shown in Fig. 2-7 and discussed in col. 6, lines 28-32, the resist 32 is applied over the mask 30. As such, the resist is not "applied to the carbonaceous material substrate" as required in claim 9.

Furthermore, Ageno does not remedy this deficiency. In Ageno, a first oxidized layer is formed, etched, and then a second oxidized layer is formed. Nowhere is there any mention of a mask formed on a carbonaceous substrate. Moreover, Ageno fails to disclose a hole formed in the first or second layer having a wall surface, and the wall surface being inversely tapered from an aperture thereof toward a bottom thereof. As such, it is clear that the combination of JP 2001-015012, Baik, Cathey and Ageno fails to teach or suggest all of the limitations of claim 9 of the present disclosure.

In addition, independent claim 13 recites a method of forming a carbonaceous material projection, the method comprising the steps of: forming a film on a carbonaceous material substrate, the film being made of one of a silicon-based nitride (SiN_x: $0 < x < 1.33$) and silicon-based nitride oxide (SiO_xN_y: $0 < x < 2$, $0 < y < 1.3$); applying a resist onto the film formed on the carbonaceous material substrate, patterning the resist by one of photolithography and electron

beam exposure to form a patterned resist of a dot shape, and processing the film by use of the patterned resist as a mask; and etching the carbonaceous material substrate by use of an etching mask including the processed film to form a carbonaceous material projection.

As claim 13 recites the feature of a film made on the carbonaceous material, in addition to applying a resist and then a mask, it is clear, for at least the reasons cited above, that claim 13 is also not disclosed by the cited prior art.

Moreover, as claims 14 and 15 have been shown above to not be anticipated by JP 2001-015012, and Baik, Cathey and Ageno do not and are not relied upon to remedy these deficiencies, it is clear that claims 14 and 15 are not rendered obvious by the cited prior art.

In order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As is clearly shown, JP 2001-015012, Baik, Cathey and Ageno do not disclose the limitations of claims 9 and 13-15. Accordingly, Applicants submit that JP 2001-015012, Baik, Cathey and Ageno do not render claims 9 and 13-15 of the present disclosure obvious and as such, claims 9 and 13-15 are patentable and allowable over the cited prior art. Accordingly, Applicants respectfully request that the § 103(a) rejection of claims 9 and 13-15 be withdrawn.

IV. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 9 and 13-15 are patentable for

the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance. As such, Applicants respectfully request that the § 103 rejection of claims 10-12 and 16-18 be withdrawn.

V. Conclusion

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication of which is respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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